THE PARTHENOGENETIC EFFECT OF ECHINODERM EGG-SECRETIONS ON THE EGGS OF NEREIS LIMBATA.

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Various methods for inducing development in the eggs of *Nereis limbata* have been tried, but, until now, only two have been successful. Fischer ('03), working in Loeb's laboratory, found that *Nereis* eggs would divide and develop to the trochophore stage if treated for half an hour with sea-water which had been made hypertonic by the addition of NaCl, KCl or sugar. Just ('15) obtained the same results by putting the eggs into sea-water warmed to 35° or 36° C. Since all other methods tried had been unsuccessful, *Nereis* acquired the reputation of being refractory to parthenogenetic methods.

Because of this reputation, I decided to see whether or not development could be induced by means of the substance secreted into sea-water by echinoderm eggs. The experiments, as shown in the table, were successful. In performing them, fresh "dry" *Nereis* eggs were allowed to stand ten minutes or more in the secretion and then transferred to sea-water, where a large proportion would exude jelly, form fertilization membranes, and become mature. Some of these, continuing development, would divide, form normal trochophores, and, finally, small worms, in every external appearance like those resulting from sperm fertilization. These have been kept until eighteen days old. It takes these parthenogenetic eggs about twice as long to reach a given stage as it does the sperm controls, a fact which serves as a nice check against accidental contamination with sperm.

Not only is development brought about by egg secretions, but the same effect may be obtained by treating *Nereis* eggs with the lipolysin obtained from the secretions (Woodward, '18).

TABLE I.

	40 sec.		1 min.		2 min.		3 min.		5 min.		7.5 min.		10 min.		20 min.		30 min.		45 min.		50 min.	
	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.	Cleavage.	Swimmers.
Asterias egg secretion													70%	1%	90%	3%	60%	Few	30%	1%		
Asterias lipolysin 1%					0	0			0	0			30%		40%				81%			
Asterias lipolysin 2%					Few	Few			Many	0			Few	Few	33%	1%			Many			
Arbacia egg secretion			0				20%		10%	1%			30%		30%		10%				1%	
Arbacia lipolysin 1%			1%		5%	1%	10%	Many	8%	Few			1%	.5%	1%	Few	2%	1%			12%	
			0		5%		2%		5%				18%		2%		4%				19%	
Arbacia lipolysin 2%			1%			3%	50%	Few		25%			30%	Few	50%	10%	60%			5%		5%
						Few		Few	Many		Many		Many									
	50%	0	50%	Few	40%	Many	35%	Few	70%	Few	60%	Few	50%	Few								
Echinarachnius egg secretion.........													50% memb.		10% memb.		10% memb.		16% memb.			
Echinarachnius lipolysin 1%[1]........				50%		1%		1%	3%													

The numbers in a horizontal row refer to experiments with a single batch of eggs.

[1] Many of these larvæ were still living eighteen days later.

Since a solution of lipolysin in sea-water may be made much more concentrated than the original secretion, it is not necessary to expose the eggs so long to its action. In fact, one of the most sensational results was the development to the trochophore stage of 50 per cent. of the eggs exposed for one minute to a solution of *Echinarachnius* lipolysin. Most of those eggs continued to develop, and formed segmented worms. The solution used, so-called 1 per cent., was made by dissolving .1 c.c. powdered lipolysin in 10 c.c. filtered sea-water.

In a third series of experiments, dilute *Arbacia* egg-secretion was passed through a Berkfeldt filter. In this process, the agglutinin remains on the filter and the lipolysin, with other substances, passes through. *Nereis* eggs which were left in this filtrate eighteen hours underwent maturation and divided regularly into eight or more cells. They were then transferred to sea-water, in which they continued to develop into normal larvæ.[1]

It was suggested by Dr. F. R. Lillie that the effect of egg-secretion was simply that of a foreign protein, and might be imitated by using cœlomic fluid. Following this suggestion, I subjected *Nereis* eggs to the cœlomic fluid from *Asterias*, treating them with various dilutions and for varying periods of time. While some eggs formed polar bodies and secreted jelly, only a few started to divide, and that very irregularly. I did not succeed in finding any method by means of which the serum would produce normal division or swimming larvæ.

These experiments with *Nereis* eggs continue a series begun several years ago by O. C. Glaser ('14) who found that *Asterias* eggs could be stimulated to divide by letting them stand in *Arbacia* egg-secretion. The following year I performed the reciprocal experiment, which helped to show that the parthenogenetic agent in egg-secretion is not specific. Later, I found that *Asterias* lipolysin produced as many larvæ in *Arbacia* eggs as did *Arbacia* lipolysin (Woodward, '18). The present work shows that the parthenogenetic agent in echinoderm egg-secretions is not even limited in its efficacy to eggs of the same phylum,

[1] This experiment was first performed by Miss M. M. Sampson and repeated by myself.

but that it is effective in bringing about development in some annelid eggs, even though the latter are resistant to the usual agents.

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